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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/089,017	07/19/2002	Ralph Wirth	12406-022001	5521
7590 11/02/2004				
Fish & Richardson 225 Franklin Street Boston, MA 02110-2804			EXAMINER DOLAN, JENNIFER M	
			ART UNIT	PAPER NUMBER
			2813	

DATE MAILED: 11/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>		<b>Applicant(s)</b>	
	10/089,017		WIRTH ET AL.	
	<b>Examiner</b>		<b>Art Unit</b>	
	Jennifer M. Dolan		2813	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 16 August 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |                                                                                         |                                                                             |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)             | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____                                                |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____                                                             | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

*This action is in response to the RCE/Amendment filed 8/16/04*

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 6- 9, and 13-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,779,924 to Krames et al. (cited by applicant) in view of U.S. Patent No. 5,744,828 to Nozaki et al.

Regarding claims 1 and 14, Krames discloses a light emitting diode, comprising: a semiconductor layer structure including a substrate (3) and at least one light-generating layer (2) formed on the substrate (figure 7c). Krames further discloses a transparent semiconductor epitaxial layer (1), deposited on the light generating layer (figure 7c), a first electrical contact layer (4) on the back of the substrate (see figure 7c), and a second electrical contact layer (4, portion on top of layer 1) deposited on the semiconductor epitaxial layer, characterized in that the top surface of the semiconductor epitaxial layer has vertical structuring to improve the decoupling of light (figure 7c; see column 3, lines 1-20; column 6, lines 25-52). The semiconductor epitaxial layer (1) of Krames is considered to act as a current-spreading layer, since the current-spreading layer is typically a thin, doped, semiconductor layer with low

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resistivity, such as an AlGaAs layer, similar to that disclosed by Krames. Assuming arguendo, the epitaxial layer of Krames does not constitute a current spreading layer.

Krames further fails to disclose that the second electrical contact provides substantially uniform coupling of the current into the current spreading layer, and that the second contact layer has a circumferential contact web structure.

Nozaki discloses a LED using a transparent current spreading layer (6) and having a second electrical contact layer (7; also see column 4, line 50 – column 5, line 10) directly deposited on the current spreading layer (figure 2), with a lateral structure (figure 1; also see column 5, lines 1-11; contact layer 7 is removed except under the electrode, and hence has lateral structuring identical to the electrode) by means of which substantially uniform coupling of the electrical current into the current-spreading layer can be achieved (see column 2, lines 12-60, column 7, lines 20-30). Nozaki further teaches that the second contact layer has a circumferential web arranged about a central contact structure (figures 1 and 8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the LED structure of Krames, such that it includes a current spreading layer and an upper electrode with a lateral structure for uniform current coupling, as taught by Nozaki. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide a current spreading layer and an electrode with lateral structure, because combination of the current spreading layer and laterally disposed electrode structure allows for an even current distribution across the entire surface of the light emitting layer, which results in improved luminous efficiency and brightness (see Nozaki, column 2, lines 12-60, column 7, lines 20-30).

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Regarding claims 6, 17, and 18, Krames, as modified by Nozaki, discloses that the second electrical contact layer (Krames, 4,9 adjacent to layer 1) is arranged on vertically structured (see Krames, figs. 9-11) and/or unstructured portions of the current spreading layer (Krames, figure 7c).

Regarding claims 7 and 13, Krames discloses that the vertical structuring is in the form of regularly arranged cones (column 6, lines 25-30; figures 5a-5c). Krames further teaches that both “sharp featured” and “soft featured” textures are known to the art (see column 4, lines 28-47).

Krames fails to specifically disclose the use of pyramidal texturing.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the texturing of Krames as modified by Nozaki, such that the texturing includes pyramids. The rationale is as follows: A person having ordinary skill in the art would have been motivated to use pyramids, because a pyramidal structure is the “sharp feature” analogous form to the specifically disclosed cones (see column 6, lines 25-30; figures 5a-5c). Although Krames teaches that the “sharp feature” forms are less desirable than the “soft feature” forms, it is quite apparent to a person skilled in the art that the use of both the “soft” and “sharp” forms are contemplated by Krames. It has been held that “A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill in the art, including nonpreferred embodiments,” *Merck & Co. V. Biocraft Laboratories*, 874 F.2d 804 10 USPQ 2d (1843). Also, it has been held that “A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use,” *In re Gurley*, 27 F.3d 551, 554, 31 USPQ2d 1130, 1132 (1994). Since the

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applicant provides no specific unexpected result or specific advantage to using pyramids over using cones, and since pyramids are an obvious “sharp featured” analogous structure to regularly arranged cones, their usage as a textured layer for improved light extraction would have been reasonably suggested to a person skilled in the art based on the disclosure of Krames.

Regarding claims 8 and 9, Krames discloses a method for fabricating a LED, such that a light generating layer (2) and thereafter an upper cladding layer which is considered to act as a current spreading layer (the layer is made of AlGaAs, which is a typical current spreading material, is thick, transparent, and meets the requirements for a current spreading layer as established in the specification of the present application) are deposited on a substrate (3) and the back of the substrate is provided with a first contact layer (4). Krames further teaches both the cases where vertical structuring is performed, and then the second contact layer is deposited on the structured surface (see figures 10-13); and the case where the second contact layer with a desired lateral structure is first provided, and then vertical structuring takes place (figures 7a-7c, 8). Krames fails to specifically point out, however, that the upper cladding material is a current spreading layer. Assuming *arguendo*, the upper cladding material does not sufficiently act as a current spreading layer.

Nozaki discloses an LED having a light emitting layer (4) with a current spreading layer (6) provided on top.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Krames, such that a current spreading layer is provided in addition to the light emitting structure, as taught by Nozaki. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide

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a current spreading layer, because doing so helps to widely diffuse the supplied current to the whole device, thus improving light emission efficiency and brightness (see Nozaki, column 2, lines 12-18).

Regarding claims 15 and 16, Krames discloses that the vertical structuring is in the form of regularly arranged cones (column 6, lines 25-30; figures 5a-5c).

3. Claims 1-4, 10, and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nozaki et al. in view of Krames et al.

Regarding claim 1, Nozaki discloses an LED having a substrate (1) and at least one light generating layer (4) formed on the substrate and one transparent current spreading layer (6) deposited on the light generating layer (figure 2), a first electrical contact layer (9) on the back of the substrate (figure 2); and a second electrical contact layer (7) directly disposed on the current spreading layer (figure 2), where the second electrical contact layer has a lateral structure by means of which substantially uniform coupling of the current into the current spreading layer can be achieved (figure 1; column 2, lines 12-18).

Nozaki fails to teach that the current spreading layer has vertical structuring to improve the decoupling of light.

Krames teaches an LED having ordered interface texturing (figure 7c) to improve the decoupling of light (column 2, line 65 – column 3, line 20; column 4, line 16- column 6, line 50).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the LED of Nozaki by vertically structuring the current spreading layer, as suggested by Krames. The rationale is as follows: One of ordinary skill in the art at the time the

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invention was made would have been motivated to vertically texture the current spreading layer, because Nozaki shows that the current spreading layer is the outermost layer of the device (i.e. interfacing with air since layer 7 is removed; see Nozaki, column 5, lines 1-10), and Krames shows that texturing the outermost layer leads to improved transmission/extraction efficiency of the LED (see Krames, column 2, line 65 – column 3, line 20).

Regarding claims 2 and 10, Nozaki discloses that the second contact layer has a circular central contact surface with a contact structure rotationally symmetrical with respect to the center point of the central contact surface, and is composed of relatively narrow contact webs (figure 1).

Regarding claim 3, Nozaki shows 4-fold symmetry (figure 1).

Regarding claim 4, Nozaki shows that the second contact layer is continuous (figure 1).

Regarding claim 12, Nozaki shows that the rotational symmetry of the second contact and that of the LED are both the same (4-fold; see figure 1).

4. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nozaki et al. in view of Krames et al. as applied to claim 1 above, and further in view of U.S. Patent No. 6,107,644 to Shakuda et al.

Nozaki as modified by Krames, fails to disclose a discontinuous second electrical contact.

Shakuda discloses that the second electrical contact (8b) for an LED may be equivalently continuous (figure 6b) or discontinuous (figures 7a, 7b) and interconnected by a layer of transparent, light-conducting material (7; figure 6a).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the electrode of Nozaki as modified by Krames, such that it is



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discontinuous, as taught by Shakuda. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide a discontinuous electrode, because Shakuda shows that discontinuous and continuous electrodes may be equivalently employed for providing uniform current distribution to an LED (see Shakuda, column 2, lines 40-46; column 12, lines 21-34; figures 6b, 7a, 7b).

5. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nozaki et al. in view of Krames et al. as applied to claim 2 above, and further in view of European Patent Application 0 544 512 to Watanabo et al.

Nozaki teaches a circular central contact surface (figure 1), but fails to disclose a square shaped central contact surface.

Watanabo discloses both circular (figures 5, 7, and 9) and square shaped (figures 10, 12, and 13) central contact surfaces.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the second contact surface of Nozaki as modified by Krames, such that the central contact surface is square shaped, as taught by Watanabo. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide a square shaped central contact surface, because Watanabo shows that both circular and square shaped central contact surfaces are recognized art equivalents, and thus can be used interchangeably for laterally structured LED contacts (see figures 5, 7, 9, 10, 12, 13).

*Response to Arguments*

6. Applicant's arguments filed 8/16/04 have been fully considered but they are not persuasive.

The applicant argues that all of the rejections rely upon Nozaki for the upper electrode with a lateral structure disposed on the current spreading layer, but in Nozaki, the electrode is not disposed on an intervening contact layer, rather than on the current spreading layer.

Although the examiner agrees that Nozaki does teach an electrode disposed on a contact layer, which in turn is disposed on a current spreading layer, the examiner does not believe that such a structure is distinguishable from the claim language presented by the applicant. Claims 1 and 14 merely require that an "electrical contact layer" is directly deposited on the current spreading layer, and that the "electrical contact layer" has a lateral structure. Since the ohmic contact layer (7) of Nozaki is an electrical contact layer, is directly deposited on the current spreading layer (see Nozaki, figure 2), and has a lateral structure to provide even current distribution (Nozaki: layer 7 is patterned identically to the electrode layer 20; see column 5, lines 1-11), Nozaki is considered to meet these recited limitations. Alternatively, the examiner maintains that the combined structure of the ohmic contact layer (7) and the electrode (20) of Nozaki could be considered to be the laterally structured contact layer of the claims, because both layers are patterned identically and act collectively to provide a good ohmic contact for uniform current distribution (i.e. to function as an electrode or an electrical contact). Hence, such a layer would still meet the limitations of having a lateral structure and being directly disposed on the current spreading layer.

***Conclusion***

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent No. 6,504,180 to Heremans et al. discloses light emitting devices using vertical structuring.

U.S. Patent No. 6,277,665 to Ma et al. and U.S. Patent No. 6,469,324 to Wang teach vertical structuring provided in a current spreading layer of an LED. These references are merely provided as being 'of interest' to the applicant, but they do not qualify as prior art.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer M. Dolan  
Examiner  
Art Unit 2813

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